Memorandum

To: Water Supply Advisory Committee members

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Subject: Additional information regarding recycled water alternatives

This memorandum provides a summary of additional information developed by Gary Fiske using the *Confluence* model (with input from Shawn Chartrand and others) on the amount of water available and system reliability improvements from the use of several potential recycled water (or desalination) alternatives [i.e., those consolidated alternatives (CAs) that are hydrology-independent]. The CAs that address this opportunity are listed in Figure 1. Additional information is provided in the detailed background memoranda provided in Attachments 1 and 2.

Several simplifying assumptions were made to the set of proposed alternatives listed in Figure 1 in order to utilize the *Confluence* model to address two fundamental planning questions:

- How much water is available to meet demands if non-potable recycled water is provided to North Coast farmers in exchange for the groundwater they currently use for irrigation purposes?
- How much water is available to meet demands if recycled water is stored (in either a surface reservoir or aquifer system) and used to meet system demands?

CA-7. Deepwater Desalination
CA-13. Water Reuse for Non-Potable
CA-15. Desalination Using Reverse Osmosis
CA-10. Water Reuse for Aquifer Recharge

Figure 1. CAs referenced in this analysis.

1. Supply Availability and System Reliability from North Coast Exchange

In order to identify the supply availability and additional reliability associated with CA-13, which sends non-potable reclaimed water to North Coast farmers in exchange for groundwater that can be extracted and treated at Graham Hill or a new treatment plant, the *Confluence* model was run with several simplifying assumptions, including:

- 4.3 million gallons per day (mgd) of non-potable recycled water are sent to North Coast farmers for irrigation purposes over a 180-day, November–April period for a total of 775 million gallons per year (mgy).

- The same volume – 775 mgy – is pumped from North Coast groundwater, at the same daily rate, for use as potable water in Santa Cruz.
- The city can exchange that water in the current year; it cannot be banked for future years.
- There are no pumping, transmission, or treatment-capacity limitations on utilizing this new supply.
- DFG-5 fish flow regulations are assumed, under both historical and climate change – impacted hydrologies.
- Demand projections used in this analysis do not include the revised demand forecast that uses the most recent input from the University of California, Santa Cruz (UCSC). However, the use of those new projections is not expected to significantly affect the results.

The water supply impacts of this alternative are similar to any of the other flow-independent sources that cannot be banked (CA-7, CA-13, CA-15). Therefore, this analysis provides insights into all three CAs. Major differences remain among these alternatives, including costs, environmental impacts, institutional constraints, etc.

Since the nature of this supply is assumed to be "use it or lose it" (i.e., it cannot be stored from year-to-year), the model utilizes this supply on any day prior to drawing on Loch Lomond. This is the most efficient way to utilize such a supply since it allows for indirect banking of this new supply by increasing carryover storage in Loch Lomond (in other words, using the new supply allows Loch Lomond supplies to remain in Loch Lomond on days when water is supplied from the groundwater exchange).

Yield

Yield is a measure of how well this alternative does in reducing peak-season shortages. The worst-year yield of this alternative (i.e., the amount by which it reduces worst-year peak-season shortages) is about 530 million gallons (mg) with historical flows, and 850 mg with climate change. Across all hydrologic conditions, the average reduction in peak-season shortage is about 45 mg with historical flows, and 410 mg with climate change.

Key findings

Given the demand-supply estimates used in this model run, under both historical and climate change flows, the severity and frequency of shortages are reduced significantly:

- Shortages are confined to the one or two worst drought years. In all other years, shortages are reduced to zero.
- The reliability improvement from this alternative is greater with climate change than with historical flows. In fact, the reliability profile with this alternative, assuming climate change, is actually better than with historical flows. This is essentially because there is much more room for improvement (i.e., need for this supply) with climate change.
- Under climate change, this alternative reduces the worst-year shortage, given current assumptions, to about 15%.
- Hydrology-independent sources (such as recycled water and desalination) have very different system impacts than sources that vary with streamflows. CA-13, the exchange of non-potable recycled water for North Coast groundwater, provides 775 mg of additional supply every year. The actual benefit of this source in dry years is significantly greater than this because of the ability to indirectly bank some of this water in Loch Lomond.

Additional information is provided in Attachment 1.

Needed infrastructure capacities

Additional treatment is required to purify the wastewater to reclaimed water standards. Also needed is the transmission capacity to move reclaimed water to the North Coast at 4.3 mgd. Production-capacity requirements for the groundwater extraction wells, as well as the transmission capacity from the North Coast to the treatment plant, is equal to the maximum required daily production of the North Coast groundwater supply, between 10 and 11 mgd.

2. CA-10 Indirect Potable Reuse

In order to understand supply availability and additional system reliability associated with storing recycled water for potable use at a future date, an additional *Confluence* model was run. This run examines CA-10, indirect potable reuse, and assumes daily recycled water production of 3.64 mgd (1,330 mgy). In this model, recycled water is stored either in a surface reservoir or in an aquifer – the virtual reservoir.

The following simplifying assumptions are applied:

- Daily recycled water production of 3.64 mg for an annual total of 1,330 mgy
- Water is stored in a virtual reservoir (possibly aquifer or surface storage)

- There are no pumping, extraction, transmission, or treatment capacity limitations on utilizing this new supply
- DFG-5 fish flow requirements
- Mid-range interim demand forecast, prior to UCSC update.

Yield

Yield is a measure of how well this alternative does in reducing peak-season shortages. The worst-year yield of this alternative is about 1,360 mg with historical flows, and 1,150 mg with climate change. Across all hydrologic conditions, the average reduction in peak-season shortage is about 60 mg with historical flows, and 420 mg with climate change.

Key findings

Given the demand-supply estimates used in this model run, the water supply impacts of this alternative are substantial: all demands (as projected prior to the UCSC changes) can be served, even in the driest years, with or without climate change, under DFG-5. In addition, because this source is fixed (i.e., hydrology-independent), it requires considerably less storage capacity [1.2 to 1.3 billion gallons (bg) versus the 3 bg needed for a flow-dependent source].

In comparison to the non-potable recycled water analysis (CA-13), more water is produced each year (1,330 mg vs. 775 mg) and the water can be stored in an aquifer or surface reservoir for use in subsequent years. Both of these features increase the availability of water in times of greatest need.

Needed infrastructure capacities

Additional treatment is required to purify the wastewater to potable reclaimed water standards. The assumed daily recycled water production capacity is 3.64 mgd; this represents the needed transmission capacity to the storage site and potentially the needed recharge capacity. Maximum production capacity, needed to meet peak season demands, for extraction and transmission from the storage site to the treatment plant during maximum production periods is between 12 and 13 mgd. Needed storage capacity is between 1.2 and 1.4 bg.

Attachment 1. Modeling Results: North Coast Reclaimed Water Exchange (CA-13)

Attachment 2. Modeling Results: Indirect Potable Reuse (CA-10)